

**Nebraska Information Technology Commission**

**Government Technology Collaboration Fund - 2001  
Grant Application Form**

For more information about Government Technology Collaboration Fund grants, see the Grant Guidelines at <http://www.nitc.state.ne.us/sgc/grants/>.

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**Section I: General Information**

**A. Project Title:** Creating a Common Framework for Integrating Surface Water Data

Submitting Agency: Nebraska Department of Natural Resources

Supporting Agencies: Nebraska Department of Environmental Quality  
Nebraska Department of Roads  
Nebraska Game and Parks Commission  
Nebraska GIS Steering Committee  
Conservation and Survey Division - UNL  
Lower Elkhorn Natural Resources District  
US Geological Survey - Water Resources Division

Contact Information for this Project

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**B. Certification for Request**

I certify that to the best of my knowledge the information in this application is correct and that the application has been authorized by this entity to meet the obligations set forth in this application.

Name: Roger Patterson  
Title: Director  
Agency: Nebraska Department of Natural Resources  
Date: August 30, 2001

Total Grant Funds Requested: \$ 25,000  
Total Project Costs: \$ 56,200

## Section II: Executive Summary

This project is part of a larger collaborative effort (*see attachment*) to develop a standardized, statewide, surface water features database (map), to facilitate the collection and integration of data and public policies of multiple state, local, and federal agencies that make or implement public policies related to Nebraska's surface water. Specifically, this project will develop a digital, (1:24,000-scale) geospatial database (map), with associated attributes, for the surface water features in the Lower Elkhorn Watershed in eastern Nebraska (all or parts of these counties: Burt, Dodge, Stanton, Washington, Platte Sarpy, Saunders Thurston, Cuming, Madison, Wayne Colfax, and Douglas). This geospatial database will be based on a National Hydrography Dataset (NHD) model, which has been endorsed by the Nebraska GIS Steering Committee and which was specifically designed to provide a common reference, surface water database to facilitate multipurpose use and inter-agency collaboration.

The project will convert existing paper maps to digital geospatial format, update the stream locations from these 1950-60s vintage paper maps based on modern aerial photography, and provide standardized database identifiers for all surface water features. The project will facilitate the collaborative use of modern information technology, such as geographic information systems (GIS), in the important public policy area of surface water by developing a standardized database for this one geographic area. The project will make information more accessible to the general public by facilitating the use of information technology tools, such as GIS, to graphically display the implications of public policies and issues related to surface water. The project is a collaborative effort undertaken by the Department of Natural Resources, the Conservation and Survey Division of the University of Nebraska, the Department of Environmental Quality, the Department of Roads, and the Lower Elkhorn Natural Resources District.

This project is a response to the Nebraska GIS Steering Committee decision to prioritize the development a standardized, statewide hydrographic dataset (*see attached resolution*). Work has already been completed in the Logan Creek watershed and is about to begin in the Salt Creek Watershed. As part of a larger effort to pool the resources from multiple agencies and thereby enable the statewide development this database, this grant funding would also be used to provide a match for federal funding that will be used to complete other basins.

## Section III: Goals and Objectives

1. Describe the project, including the specific goals and objectives.
  - a. Promote the collaborative development of priority geospatial databases by building on an intergovernmental pilot project, adopting database standards endorsed by the Nebraska GIS Steering Committee, provide state matching funds for federal grant funding, and by demonstrating an organizational model for such collaborative development.
  - b. Enhance the ability of state agencies, communities, local governments and other entities to incorporate issues related to surface water into public policy and infrastructure planning considerations by more clearly communicating these issues to policy makers and the general public through current, high-resolution digital maps.
  - c. Develop a digital map of surface water features (streams, lakes, etc.) at a map scale of 1:24:000 (spatial accuracy of  $\pm 40$  ft.) for this specific watershed and the communities in this area.
  - d. Revise and update existing maps to reflect changes in the shape and location of surface water features (stream channels, lakes, etc.) from 1950-60s vintage data to current locations provided by 1993-99 aerial photography.
  - e. Enhance public policy development and implementation by facilitating interagency data integration and exchange through standardized identifiers provided as associated attributes for all surface water features (stream segments, lakes, etc.).
  - f. Facilitate the collaborative public/private use and implementation of modern information technologies, such GIS, by cooperative development of a standardized database that provides a common data infrastructure for numerous applications.
2. Describe the project's relationship to the agency's comprehensive technology plan.

Page 22 of the current Nebraska Department of Natural Resources Agency Comprehensive Information Technology Plan lists Development of a high-resolution 1:24,000 scale National Hydrographic database as a future

planned activity. It notes that: *"The NHD would support the Flood-prone area mapping project, water rights mapping, state and local water quality projects, management of T&E species, and determination of water delivery or availability under varying assumptions. A hydrographic database could form the basis of the surface water modeling portion of surface water – groundwater relationship studies. All of these uses have potential applicability to future DNR planning studies."*

3. Describe, if applicable, how this project furthers the implementation of electronic government. [Preference will be given to projects which support the State Government Council's priority of implementing electronic government as reflected in the goals of the Business Portal Action Plan and the E-Government Strategy (available at <http://www.nitc.state.ne.us/sgc/>).]

Goal #1 of the E-Government Strategy states, *"Anyone needing to do business with state government will be able to go to the state's Web site, easily find the information or service they need, and if they desire, complete all appropriate transactions electronically."* Water is an important component of Nebraska's economic, legal and social fabric. The most user friendly way to use the Web to reference and/or search for information related to surface water is to tie that information to a graphical map of surface water features. This project will contribute to the statewide development of a high-resolution, graphical depiction of Nebraska's surface water features. This database/map, with its standardized identifiers, will provide the data infrastructure necessary to cross-reference surface water data from multiple agencies and graphically reference them via the Web.

Goal #2 of the E-Government Strategy states, *"State agencies will improve services and increase the efficiency and effectiveness of government operations through collaboration, communication, and data sharing between government agencies at all levels."* As this project title indicates, the project will create a database that will provide a common framework for integrating surface water data from multiple state, federal, and local agencies. Currently there is not a universally used set of surface water feature identifiers and so different agencies use multiple systems of feature identifiers, making very difficult to integrate this data. This project, following the national standards built into the National Hydrography Dataset (NHD) model, will provide a system of common identifiers that can be used to cross-reference those multiple databases. This goal also speaks to the importance of strengthening coordinating groups like the Nebraska GIS Steering Committee, *"Continue and expand upon current intergovernmental cooperative efforts like the CJIS Advisory Committee and the GIS Steering Committee..."* From its beginning, this project has been a collaborative effort which grew out of and has been supported by the Nebraska GIS Steering Committee.

Goal #4 of the E-Government Strategy states, *"Agencies will work with other state agencies and local governments to develop strategies for using Internet technologies to provide integrated access to information and services to citizens, businesses, employees, and other government entities."* As was noted above, this project, which is supported by multiple state and local agencies, will provide the data infrastructure that will ultimately allow for a web-based graphical interface to access data, from multiple agencies, related surface water features. This goal also speaks to the importance of organizing electronic access around "life events", as a way to facilitate ease of access. For most people, providing a clickable map of a stream or lake is probably the most user-friendly way of referencing that information.

Section 4 of the E-Government Strategy addresses the importance of developing ways to support and fund collaborative projects, data sharing, and the development of shared infrastructure. This project shares all of those characteristics at its core. It has been a collaborative project from the beginning. One of its primary goals is to facilitate data sharing among the multiple agencies that collect and analyze surface water data. The project's primary focus is the development of data infrastructure that will be used by multiple agencies to reference their surface water data, to correlate it with the data from other agencies, and to facilitate access to this data by the general public and other agencies.

The Business Portal Action Plan speaks to the importance of steps to, *"Enhance the state's business portal to make finding information and services easier and quicker."* As has been noted earlier, the development of a high-resolution graphical/map of Nebraska's surface water features is a key step in providing the data infrastructure that will be necessary to enable a user-friendly, graphical interface to a broad range of surface water data via the web. The Long Term Action Items in Section 3 of the Business Portal Action Plan includes the following action item, *"Investigate Integrated Access Via the Internet to GIS Data and Attributes from Multiple Sources, Including Interactive Mapping Technologies."* As noted above, the focus of this project is the development of data infrastructure that will be a key to enabling integrated web access to surface water data from multiple sources.

Section 4 of the Business Portal Action Plan speaks to the difficulty of funding enterprise-wide projects. *"Funding for infrastructure and enterprise-wide applications presents special challenges. It is difficult for agencies to invest in shared infrastructure projects that go beyond their statutory responsibilities or programmatic needs. This is particularly true for projects that transcend political jurisdictions. The business portal action plan recognizes the enterprise nature of certain projects, which may require alternative sources of*

*funding.*" This section speaks directly to the challenges faced by this collaborative effort to develop the data infrastructure needed by multiple agencies that collect and analyze surface water data. The support of the NITC would be very helpful in overcoming the funding challenges associated with this collaborative, enterprise-wide project.

## Section IV: Scope and Projected Outcomes

Describe the project's specific scope and projected outcomes. The narrative should address the following:

1. Beneficiaries of this project and the need(s) being addressed;
  - a. The **Department of Natural Resources (DNR)** anticipates several applications of the NHD database in pursuit of both their management and regulatory roles relative to Nebraska's water and other natural resources.

Floodplain Mapping. Floodplain Management Division of DNR is currently working on a project "Large Area Floodplain Mapping Initiative" that could utilize a statewide, high quality vectorized stream coverage at a scale of 1:24,000 or better. Currently, this initiative utilizes Digital Elevation Models (DEM) and Digital Orthophoto Quads (DOQ) databases along with existing hydrologic and hydraulic information, and other engineering computations required to map 100-year floodplains throughout the state. The computation process requires accurate stream lengths and slopes along the stream reaches, which is not adequately provided by the DEMs. Other sources of information, such as TIGER line files, also do not provide the necessary accuracy for this project. The beneficiaries of this application would be those all those individuals, businesses, and municipalities who are at an economic disadvantage due to inadequately defined 100-year floodplain boundaries.

Water Rights. An accurate and complete 1:24,000 NHD type spatial database of streams would also be used in DNR's water rights mapping program. The Department has set a goal to digitize its water rights maps. An accurate stream, lake and reservoir network would be an important element in those maps. It would also be useful to tie in our downstream order scheme to stream ordering schemes used by other agencies. The stream reach coding implemented in the NHD projects would be useful for this purpose. In addition to helping to make the agency personnel who work with this data more efficient, other beneficiaries would include those individuals, business, municipalities, and other public entities that depend on surface water for their businesses or quality of life.

Other Likely DNR Uses. Such a database would allow DNR's Dam Safety Program Engineer to enhance his dam site maps. The ground water registration section may be able to use it as a tool to identify wells in close proximity to a stream; which would require the well owner to obtain a surface water permit. The database would also be useful in scientific and administrative programs dealing with interstate compacts and litigation support, as well as, watershed planning, terrain modeling and other project studies.

- b. The **Department of Environmental Quality (DEQ)** would likely use this standardized, 1:24,000-scale surface water features database in a wide range of both regulatory and non-regulatory applications. The ultimate beneficiaries of these applications will be the general public for whom surface water quality is factor in both our economy and our quality of life

Standardized Stream Segment Delineation and Identification. Stream segment delineation contained in Title 117 - Nebraska Surface Water Quality Standards is based on the information contained on USGS 1:24,000 scale quad maps. If the Department of Environmental Quality (DEQ) is to use GIS tools in describing or implementing T117, geospatial data based on the 1:24,000 scale maps would be preferable.

Surface Water Quality Enforcement. DEQ's water quality assessments are based on sampling to represent entire segments. Similarly DEQ's reporting reflects the support or non-support of uses assigned in the Standards. They report their results as miles of streams supporting, which segments support, acres of lakes, which lakes support, etc. EPA requires this method of reporting for their programs. Since the basis of DEQ's reporting units are the waterbodies identified in T117, use of a 1:24,000 scale coverage would be preferred when using GIS in this activity.

Total Maximum Daily Load and Waste Load Allocations Permits. The Total Maximum Daily Load calculations (TMDL) and Waste Load Allocations for the DEQ permits program relies on hydrology variables as input to the modeling process in addition to the linear routing. Some of these variables would

be included in a GIS data layer or could be associated with such a data layer. Since the basis of DEQ's authority for these permits relies on T117, use of a 1:24,000 scale coverage would be preferred when using GIS in this activity.

TMDL for Non-point Source. DEQ's TMDL efforts for the nonpoint source program uses similar information as outlined above for stream segments, except in a non-regulatory manner. The same rationale for needing 1:24,000 scale coverage holds for the nonpoint source program.

- c. The **Department of Roads, Bridge Division** would likely use such a surface water database in the hydrologic modeling they do related to the design of bridges. An accurate depiction of the current location and shape of the streambed, combined with Digital Elevation Models (DEMs) and a logically connected stream flow network would enhance their ability to conduct upstream flow analyses.
- d. The **Lower Elkhorn Natural Resources District (LENRD)** and the communities and citizens in its service area would be among the primary beneficiaries of this project. Surface water is one of the major natural resources that NRDs are statutorily charged with managing. Other areas for which NRDs also has responsibility are also impacted by surface water related issues, such as: flooding, soil erosion, recreation, and groundwater.
- e. As part of a needs assessment conducted by the Nebraska GIS Steering Committee, a wide range of public agencies indicated that they have a need for this type of data and would use a standardized surface water database if it were available. In addition to those applications listed above, other likely applications that were listed in a recent GIS Strategic Plan adopted by the Nebraska GIS Steering Committee include the following:

Central Platte NRD: standard reference for surface water sample locations, and drainage basin characteristics.

Nebraska Game and Parks Commission: enhanced stream information for fisheries management and wildlife management and protection, enhanced lake information for recreation areas and wildlife management.

Nebraska Dept of Agriculture: devising and overseeing implementation of a statewide vegetative buffer strip plan around surface water features.

- f. The ultimate beneficiary of most of these applications are citizens who benefit from these widely varied public programs that would be facilitated by the availability of this standardized, current database on Nebraska surface water features. These citizens will receive further benefits from the increased likelihood of inter-program coordination due to these multiple programs using a common surface water database.

2. Expected outcomes of the project;

- a. Development a digital map of surface water features (streams, lakes, etc.) at a map scale of 1:24:000 (spatial accuracy of  $\pm 40$  ft.) for this specific watershed and the communities in this area.
- b. Revision and updating existing source maps to reflect changes in the shape and location of the surface water features (stream channels, lakes, etc.) from 1950-60s vintage data to current locations provided by 1993-99 aerial photography.
- c. Implement standardized identifiers for surface water features (stream segments, lakes, etc.), based on EPA River Reach Coding, by providing identifiers as attributes associated with all surface water features in the database. As these standard identifiers are adopted, they will enable links between the GIS and existing surface water databases and between multiple agencies' databases.
- d. Promote the collaborative development of statewide priority geospatial databases by building on an intergovernmental pilot project and adopting database standards endorsed by the Nebraska GIS Steering Committee and by demonstrating an organizational model for such collaborative development.
- e. Provide state matching funds for federal grant funds that are being sought to complete this standardized database for additional watershed basins.

3. Measurement and assessment methods that will verify project outcomes;

- a. The proposed surface water database is based on a database model (National Hydrography Dataset, NHD) jointly developed by the US Geological Survey and the US Environmental Protection Agency. In

developing this model, they also developed software tools to assist in its development and to test its operability. These tools will be used to develop and test the final database.

- b. The database will be submitted to the USGS for final review, quality control and for approval of both the digital line work and the standardized identifier attribute coding.

## **Section V: Project Justification / Business Case**

Please provide the project justification in terms of tangible benefits (an economic return on investment) and/or intangible benefits to the agency or the public. The narrative should address the following:

1. Tangible: Economic cost/benefit analysis;

Available resources and time do not permit a detailed cost/benefit analysis of this project. However, a GIS Strategic Plan recently adopted by the Nebraska GIS Steering Committee reported on a 1998 cost/benefit analysis of GIS implementation in state and local governments in Montana. That analysis of 10 case studies (4 local government and 6 state government) ... *"predicted benefit/cost ratios ranging from 1.2 - 5.6 for case studies producing effectiveness benefits. In other words for every dollar spent on running a GIS application the return on investment ranged from \$1.20 to \$5.60."* While one can not directly generalize from that study to this specific project, that study does speak to a general cost effectiveness of GIS that has been shown over multiple state and local government applications.

As has been noted previously in this application, a major portion of the cooperating project partner's work involves issues directly and indirectly related to surface water. Most of these project partners have already made a significant investment in GIS technology. The development of an accurate, comprehensive, and current digital map of the surface water features in this watershed area will provide them with a key component of the needed data infrastructure to apply this technology investment to surface water-related issues. This project will also lay the technical and organizational foundation for the development of similar surface water databases for the other watersheds in this general area.

It is likely that the greatest cost/benefit from this project will be realized by the fact that once this geospatial database has been created, multiple state, local and federal agencies will commence to use it as a common reference database for numerous applications and data collection activities. When these multiple agencies adopt this database, they will also adopt the standardized identifiers for surface water features built into the database structure. This will then lay the foundation for integrating a wide variety of agency databases related to surface water.

The life cycle cost of this project involves an almost exclusively a one-time, up-front investment in data development. Once the initial investment to develop this database has been made, it will require very little investment to maintain the database over a very long period of time (30-40 years). Because the database is digital, any changes in a particular stream location or shape can be modified with relative ease and re-distributed. In the meantime, wide spread benefits will accrue through the wide spread use of this standardized database and the associated database standards that facilitate data integration.

2. Intangible: Benefits of the project for customers, clients, and citizens and/or benefits of the project for the agency;

The availability of this standardized, high-resolution surface water features database will enable the project partners and other users to apply the spatial analytical tools of GIS to public policy and management issues related to surface water. This database, in combination with the graphical capabilities of GIS, will also allow the project partners, and other users, to graphically display issues related to surface water public policy and management and thereby facilitate communication related to these issues with specific landowners and the general public and facilitate their understand and input. For example, this database would helpful in signing farmers up for the Nebraska Buffer Strip program. With good mapping this becomes a simple procedure as stream centerlines set the eligibility parameters for the program. Also, this database used in conjunction spatial databases related to soils, surface elevation, land use and riparian buffer strips could be used to model and display the relative tendency for soil erosion and/or stream or lake waste loading in a given area. As multiple agencies adopt the standardized identifiers for surface water features built into this database, this database will also facilitate the integration of surface water data across multiple agencies and support more consistent and integrated management and public policy decisions. As an example, agencies such as NDEQ, NGPC, USGS and NRDs collect water samples from a wide variety of stream segments for a variety of programs. Common stream segment identifiers will facilitate the integration of this data across agency and program lines. Other example applications are delineated in Section IV.1.

3. Other solutions that were evaluated and why they were rejected. Include their strengths and weaknesses. Explain the implications of doing nothing and why this option is not acceptable;

An interagency Water Resources Database Advisory Committee convened on behalf of the Nebraska GIS Steering Committee considered the need for and alternatives to realize water-related databases. After identifying 26 needed water-related databases, this Advisory Committee prioritized the surface water features database as the highest priority for development. Four alternative solutions or approaches were considered relative to addressing the need for a digital, geospatial, surface water features database.

Do Nothing. It was recognized that most state and local surface water data collection, public policy development and management efforts are currently based on 1:24,000 scale USGS 7.5 minutes paper topographical maps. A digital geospatial replication of these maps does not currently exist for most of Nebraska. Because of the power and efficiency of GIS, it was widely expected that absent the development of a comprehensive, standardized, hydrographic geospatial database, that multiple agencies would likely develop their own unique hydrographic databases to serve their particular agency needs for specific areas of Nebraska. It was expected that this approach would result in a wide spread, costly duplication of effort. It was also expected that this approach would result in non-standard hydrographic databases that would be very difficult to integrate over the same or adjoining geographic areas. Such a non-coordinated developmental approach would likely be more costly and would result in data that could not be easily shared or integrated.

1:100,000 Scale NHD. The USGS and EPA jointly developed a database model and a nationwide 1:100,000-scale National Hydrography Dataset (NHD). This database was evaluated by the Advisory Committee and found to be lacking for many applications. The Advisory Committee found that many of the special features incorporated in the NHD database model were well-designed to serve the multipurpose needs of a wide cross-section of users. However the Advisory Committee concluded that the low-resolution of a 1:100,000-scale database was not appropriate for many state and local applications. A 1:100,000-scale database has a spatial accuracy of  $\pm 167$  ft. and the Advisory Committee felt that a 1:24,000 scale ( $\pm 40$  ft.) database was more appropriate for most state and local applications. It was also noted that in the highly generalized 1:100,000-scale database many stream segments and smaller tributaries were not represented.

Existing 1:24,000 Scale Database. Several years ago the Nebraska Natural Resources Commission developed a digital 1:24,000-scale hydrographic database as part of its effort to delineate watershed basins. For the purposes of this project, the NNRC captured only the major stream in each watershed area. The Advisory Committee evaluated this database for its suitability to serve as a general surface water features database for Nebraska. While this database was at the desired map scale, the Advisory Committee found it to be lacking in several key areas. Because the initial intent was to only capture the major stream in each watershed, numerous stream segments of interest to many agencies were not represented. This existing database only captured the stream centerline and therefore didn't include the stream banks or lakes that are represented on the 7.5-minute topographical maps. This database also did not include any standardized identifier attributes for stream segments to facilitate data sharing and integration. Samples of this database were given to USGS to evaluate as a potential starting point for the development of a 1:24,000-scale NHD and USGS determined that it would not be cost-effective to attempt to develop an NHD database based upon this existing 1:24,000-scale database.

1:24,000 NHD. The Advisory Committee recommended that best long-term solution would be the cooperative development of a 1:24,000-scale NHD. This database would be based on the multipurpose database model developed for the 1:100,000 NHD, which incorporates several special features, designed to facilitate its multipurpose use. The Advisory Committee concluded that the combination of these database features with a 1:24,000 scale digital map would provide a hydrographic database that would serve the needs of a wide variety of state and local applications. As such, once this database was developed it would likely be widely adopted and the standards incorporated in the database would facilitate wider data sharing and integration. The Advisory Committee recommended the statewide development of this hydrographic database model and the Nebraska GIS Steering Committee adopted this recommendation and included it in its Nebraska GIS Strategic Plan of September 2000.

4. If the project is required to comply with a state or federal mandate, please so indicate.

There are no known specific state or federal mandates that directly relate to this project. However, as noted in response to question 4 above, the hydrographic database model proposed for this project is consistent with the database model recommended for statewide development by the Nebraska GIS Steering Committee. Both the Nebraska GIS Steering Committee and the Federal Geographic Data Committee have placed a priority on the

development of a standardized geospatial hydrographic database to serve as common data infrastructure for a wide variety of applications. This project is seen as an important step in an effort to support statewide development of such a standardized database.

## Section VI: Implementation

Describe the implementation plan -- from design through installation and ongoing support -- for the project. The narrative should address the following:

1. Project sponsor(s) and stakeholder acceptance analysis;

As outlined in section IV-b, a needs assessment conducted by the Nebraska GIS Steering Committee determined that a wide range of public agencies need and would use a high-resolution, standardized surface water database if it were available. As outlined in section V-3, and interagency Database Advisory Committee, convened in response to this needs assessment, explored several alternatives to address this need and recommended statewide development of a standardized surface water features database based on the model incorporated in this proposed project. Attached to this proposal are letters from the Conservation and Survey Division - UNL, the Department of Environmental Quality, the Department of Roads, and the Lower Elkhorn Natural Resources District expressing their support for this proposal and committing their agencies to work cooperative with the project sponsor, the Department of Natural Resources, to develop this standardized database for one specific watershed. Also attached is a letter of support from Nebraska Game and Parks Commission and a resolution passed by the Nebraska GIS Steering Committee in support of the development of this standardized hydrographic database for this particular watershed.

2. Define the roles, responsibilities, and required experience of the project team;

The project sponsor and agency responsible for overall management of the project is the Department of Natural Resources. Cooperating partners in this endeavor will be the Department of Environmental Quality (DEQ), the Conservation and Survey Division - UNL, the Department of Roads, and the Lower Elkhorn Natural Resources District. A high proportion of the total work hours required for this project involve the hand digitizing of stream and bank locations from digital aerial photography. While this work requires a reasonable level of familiarity with stream networks and computers, it does not require a particularly high level of technical expertise. This project proposal will continue an effort to explore the feasibility of utilizing college students to do this time consuming hand digitizing work. It is hoped that college students, particularly those interested in natural resource issues, can provide a cost-effective pool of reasonably skilled part-time digitizers. This project will work with the Conservation and Survey Division (CSD) to recruit and hire part-time student intern(s) or graduate student(s) to do this hand digitizing for the Lower Elkhorn Watershed and further develop this capability for a potential statewide effort.

The technical expertise for the project will be provide by the staff of the Department of Natural Resources based on the experience they have gain through an earlier NHD pilot project in another northeast Nebraska watershed. This staff has developed a familiarity with the NHD database model and the particular tools designed to develop and test the database. This technical staff will work with CSD to recruit and hire student digitizers and will provide the training and day-to-day oversight of these student digitizers. It is anticipated that DNR will also provide the workspace for these students. DNR technical staff will also be responsible for completing the final specialized work of incorporating the special NHD attribute features into the database (conflation/post-conflation).

If this proposal is funded, it is anticipated that arrangements will be made with the US Geological Survey to conduct quality assurance and control procedures on the final product.

This overall project is designed with the dual purpose of 1) developing this needed database for one particular watershed and 2) to continue the development and testing of procedures, tools and organizational arrangements for the cooperative development of this database on a statewide basis.

3. List the major milestones and deliverables for each milestone; **(need Josh's input on this)**

- a. Develop specialized software tools for students to use to digitize and do initial attribution of surface water features. *(1<sup>st</sup> month)*
- b. Hire and train (2-3) students to do digitizing *(1-4 months depending on grant fund availability timeline relative to student worker availability during fixed summer and/or semester timelines)*



- c. Complete digitization of surface water features in Lower Elkhorn Watershed area (*3-5 months from initial hiring depending on student availability*)
- d. Conflation/post-conflation — final specialized work of incorporating and checking the special NHD attribute features into the digitized database developed by the students (*1-2 months following completion of digitizing*)
- e. Quality assurance and control — USGS conduct quality assurance and control of the final product (*completion of final USGS review uncertain because of current backlog at USGS*)

Note. A major variable for milestone timelines for this project relate to the available of student workers and their fixed work periods (semesters and summers) relative to grant fund available. However, even given this unknown, it is expected that the project can be completed within a year's timeline.

4. Training and staff development requirements and procedures;

The primary training and staff development needs will be related to training the anticipated student digitizers to use the specialized digitizing tools and to developing a basic understanding of the NHD database model and stream tributary relationships. Depending upon their previous experience, limited training may also be necessary in ArcView GIS software. DNR technical staff will continue to work with USGS NHD specialists to enhance their understanding of the specialized NHD development tools. During the course of this project efforts will also be made to expand this base of NHD technical expertise to one or more additional DNR staff members to minimize the impact of potential staff turnover.

5. Ongoing support requirements, plans and provisions.

Stream channels do change over time, and as they change it will be desirable to revise the database. Long-term maintenance provisions for this dataset are still under discussion, as plans for the statewide development of this dataset are still evolving. It is likely, at this point, that the primary maintenance responsibility will rest with the Department of Natural Resources, with local agencies such as the NRDs and local governments playing a leading role in identifying when a given database needs revision. At this point it is anticipated that this database will be available online from the Department of Natural Resources. Parallel efforts are under discussion and are anticipated, by agencies interested in this dataset, to develop specific example applications to demonstrate the various features and capabilities built into the dataset.

## Section VII: Technical Impact

Describe how the project enhances, changes or replaces present technology systems, or if new systems are being added. The narrative should address the following:

1. Descriptions of hardware, software, and communications requirements for this project. Describe the strength and weaknesses of the proposed solution;

We anticipate that the project will require the use of one GIS-capable workstation with an Arc/Info license for each FTE assigned to digitizing. These workstations will also require Office2000. An existing workstation will be used for the technical-management component of the project, which has an Arc/Info license. ArcView 3.2, ArcGIS, GRID, NETWORK and SDE software will be required for this project and NDNR currently has this software available. One additional workstation with ArcInfo software, plus a secondary ArcInfo license for another existing computer, will be purchased. This additional hardware and software will then be available for use in further NHD development efforts, as additional funding becomes available.

2. Issues pertaining to reliability, security and scalability;

Implementation of the NHD process is, from a time standpoint, dictated to a large extent by digitizing. NHD could be developed faster with additional digitizing capacity. Acquiring additional GIS workstations configured like the one described in section 1 for each additional FTE could increase digitizing capacity, assuming that additional student digitizers were available.

The NHD database model itself is designed to allow for further enhancement through increased spatial accuracy and stream network detail.

The NHD database model itself is a national standard for capturing hydrographic data and has been endorsed by the Nebraska GIS Steering Committee and the Federal Geographic Data Committee.

NHD development was designed on and for systems using Arc/Info-ArcView GIS software. All modifications to the existing process have been implemented on Arc/Info-ArcView as well. Arc/Info and the related ESRI family of Arc software products are a very widely used GIS industry standard. Because of its wide spread use, most GIS software has at least a limited capability to import Arc files.

Section V.4. of this application outlines the rationale and process for selecting the NHD database model as opposed to others that were considered.

3. Conformity with applicable NITC technical standards and guidelines (available at <http://www.nitc.state.ne.us/standards/>) and generally accepted industry standards;

The NITC technical standards and guidelines that would primarily apply to this project, "Data and Information Architecture" have yet to be developed. The online NITC technical standards document currently refers to the Nebraska GIS Steering Committee for more information about these standards in development. The Nebraska GIS Steering Committee has endorsed this project and the NHD database standards upon which it is based.

4. Compatibility with existing institutional and/or statewide infrastructure.

NHD is developed in Arc/Info and uses Arc/Info objects to define routes and regions to identify components of the database. This results in a somewhat platform-specific database. Arc/Info is an industry standard. In Nebraska, it is likely that most users are using an Arc or Arc compatible software. The major exception to this is the Nebraska Department of Roads, whose main GIS software is Intergraph. However, NDOR also has Arc/Info software. It is likely that most GIS systems will be able to import and use the digital line work of the NHD database, but some may be limited in their ability to utilize some of the higher-end, built-in attribute features. Further application development will be needed to explore the specific impact of built-in Arc features relative to their availability to other GIS software.

## Section VIII: Risk Assessment

Describe possible barriers and risks related to the project. The narrative should address the following:

1. List the identified risks, and relative importance of each;

A risk assessment of this project was conducted by an interagency working group that was been involved in the development of this proposal and the development and implementation of an early Nebraska NHD pilot project. Areas of potential risk were identified based on previous experience and the new aspects that were incorporated in this particular project design. Possible mitigating actions for each of the identified risks were outlined. The identified risks are listed below in order of their anticipated levels of risk.

- a. Impact if project is not completed as proposed.
- b. Difficulty of recruiting and maintaining quality student digitizers;
- c. Maintaining a consistent, high-quality digitized product;
- d. Loss of technical staff expertise/experience gained in previous NHD pilot project;
- e. Complications related to multiple project partners;
- f. From scratch digitizing versus editing; and
- g. Unanticipated conflation/post-conflation process step complications.

2. Identify strategies, which have been developed to minimize risks.

- a. Impact if project is not completed as proposed. On one level, the failure to complete this project as proposed will mean that agencies needing this type of database for their applications will not have it available, at least in the near term, for this particular watershed area. This means that those applications will either not be able to be pursued or they will be done using lower quality data. For some, it will probably result in efforts to develop some variant of this database, which will likely not serve the multi-agency, multi-purposes of the NHD database. To minimize these risks, the project partners have been systematically working with collaborative IT planning bodies, such as the Nebraska GIS Steering Committee and the NITC, to lay the foundation for the coordinated investment in the development of this key component of our shared data infrastructure.

On another level, the impact may be more significant. This project proposal is the latest step in a series of cooperative interagency steps to identify and jointly develop a widely needed component of our shared geospatial data infrastructure. This cooperative effort, under the auspices of the Nebraska GIS Steering Committee, has prioritized for development a standard reference surface water features database. Based on this prioritization, an interagency working group has researched database models and recommended the NHD model and an initial cooperative pilot project has been undertaken to explore the resources needed and further develop the guidelines for a Nebraska NHD.

The GIS Steering Committee and the project partners have also worked to secure commitments (both in-kind and direct) from several partners to help build support and momentum for the larger statewide development effort. The most recent and significant is an offer of a \$50,000 grant from the Department of Environmental Quality's Non-point Source Fund to support statewide NHD development. While this \$50,000 is far short of the estimated 2 million dollars it will take to develop this standardized database statewide, it is a significant step in building the state/local/federal partnerships that will be necessary for this statewide development effort to succeed. These are federal funds that must have a 40% match from state and local funding. If approved, this grant would meet a significant portion of that match requirement and assist the Nebraska GIS Steering Committee in its efforts to continue to develop the organizational base and funding for the cooperative development of this key piece of our data infrastructure. The DEQ funding not applied directly to this specific watershed will enable the Nebraska GIS Steering Committee to work with other potential partners to leverage other funding sources to support the development of this database in other areas of Nebraska. Section 4 of the Business Portal Action Plan speaks to the difficulty of organizing and funding enterprise-wide projects. This proposed project is another step to further explore developmental approaches and cooperative organizational model that might be applied to a statewide data infrastructure development effort. While it hopefully will not spell the end of the systematic effort to cooperative fill a common data infrastructure need, if this project does not go forward, it will be a set back.

- b. Difficulty of recruiting and maintaining quality student digitizers — There is a limited pool of college students who might be interested and qualified for this type of digitizing work. It is not particularly technically demanding, but it is tedious and requires a commitment to high quality. To minimize the potential impact of these risks, the project has budgeted student personnel costs at the upper end of the current University student pay scale. Additional time has been built into the project timelines to accommodate for the possibility of student worker turnover and difficulty of recruiting student workers outside of standard semester work periods.
- c. Maintaining a consistent, high-quality digitized product — Prior to starting their digitizing work, students will be given training on the digitizing tools, the NHD database model, and the overall development process. Because of the tedious nature of hand digitizing work, the project timeline is based on 20-hour workweek for student digitizers. It is anticipated that exceeding this 20-hour average would result in a significant decrease in the quality of the digitized product. Student workers will be asked to work at DNR so that DNR technical staff can monitor their work on an on-going basis.
- d. Loss of DNR technical staff expertise/experience gained in previous NHD pilot project — Four DNR staff members have received at least a limited amount of initial USGS training on NHD development tools and processes. These staff members will participate in additional training in the next few weeks as USGS technical personnel visit DNR to conduct the conflation/post-conflation processes for the initial pilot project and train DNR personnel in those processes. However, one key DNR staff member (Josh Lear) has, at this point, done most of the technical development work on the NHD pilot project and it is his experience that is most critical to this proposed project. Mr. Lear is very supportive of NHD development statewide, he has been actively involved in the development of this specific project proposal, and sees it as a pivotal next step in the effort to develop this database on a statewide basis. The administration of DNR has committed Mr. Lear's time and support to this proposed project. During the course of this proposed project efforts will be made to broaden the experience of other DNR technical staff on the NHD development process.
- e. Complications related to multiple project partners — The proposed project involves the cooperative efforts of three public agencies coming from three different levels or types of agencies (a regional NRD, a state code agency, and a university division). The risks associated with organizational complexity have been somewhat mitigated by meetings to develop this proposal that have involved the staff and directors of all three agencies. Agency directors have expressed their support for this cooperative endeavor, with consideration for it being a possible pilot for a larger statewide effort. All three agencies are members of the Nebraska GIS Steering

Committee, which has endorsed and prioritized this project. Periodic meetings involving representatives of the three agencies will be held to monitor the progress of the project and to address any developing problems.

- f. From scratch digitizing versus editing — The initial Nebraska NHD pilot project was based on editing existing line work representing 1:24,000-scale surface water features. Because 1:24,000 surface water feature line work does not exist for most of Nebraska's geographic area, and for the project area of the Salt Creek Watershed, most of these line work databases will need to be created from scratch based on heads-up digitizing of aerial photography. This will be a change from the NHD pilot project experience and may add complications or require additional digitizing time. The experience of DNR staff, Josh Lear, in editing the existing line work to current aerial photography locations has lead him to believe that it will be as fast or faster to do this digitizing from scratch. Some additional time and resources for digitizing have been built into this proposal to compensation for the possibility that may not prove to be true. In addition, a written request has been sent to USGS to specifically identify the minimum subset of attributes that are needed for digitized line work to work with existing NHD development software tools.
- g. Unanticipated conflation/post-conflation process step complications — At the time that this proposal was being developed, the final stages of the Nebraska NHD pilot project (conflation/post-conflation) has been completed once. However, this complex process and the related software tools are currently undergoing ongoing evolutionary development by USGS personnel. It is possible that as part of these process steps unanticipated problems will be encountered. However, USGS has committed itself to work with and train Nebraska personnel in these processes, so it can be reasonably assumed that any problems can be worked through.

## Section IX: Financial Analysis and Budget

1. Provide the following financial information:

	GTCF Grant Funding	Cash Match	In-Kind Match	Other Funding Sources	Total
Personnel Costs	\$2,000		\$15,800		\$17,800
Capital Expenditures (Hardware, software, etc.)	\$ 4,000 hdwr \$ 5,000 sftwr			\$5,000 Roads	\$14,000
Contractual Services	\$12,000 othr		\$1,000	\$3,000 - LENRD \$5,000 - NDEQ	\$21,000
Supplies and Materials			\$ 1,400		\$1,400
Telecommunications					
Training	\$2,000				\$2,000
Travel					
Other costs					
<b>Total</b>	\$25,000		\$18,200	\$13,000	\$56,200

①

②

③

2. Provide a detailed description of the budget items appearing above.

**Section IX: Financial Analysis and Budget -- Detail**  
**Creating a Common Framework for Integrating Surface Water Data**

	CTF Grant Funding (hrs.)	CTF Grant Funding (\$)	In-Kind Match (hrs.)	In-Kind Match * (\$)	Other Funding Sources (hrs)	Other Funding Sources (\$)	Total (hrs)	Total (\$)
Proces & Tools Dev. - Design			120	\$6,000			120	\$6,000
Hire and train digitizers	40	\$2,000	60	\$3,000			100	\$5,000
Supervision of digitizers			32	\$1,600			32	\$1,600
Cnflation & post-cnflation			64	\$3,200			64	\$3,200
Technical/Mgmt. Subtotal	40	\$2,000	276	\$13,800			316	\$15,800
Project mgmt - DNR			40	\$2,000			40	\$2,000
<b>Personnel (1)</b>		<b>\$2,000</b>	<b>296</b>	<b>\$15,800</b>			<b>20</b>	<b>\$17,800</b>
Computer Hardware		\$4,000						\$4,000
Software		\$5,000				\$5,000		\$10,000
<b>Capital expenditures (2)</b>		<b>\$9,000</b>				<b>\$5,000</b>		<b>\$14,000</b>
Digitizing/Editing	600	\$12,000			400	\$8,000	1,000	\$20,000
Digiting Subtotal (3)	600	\$12,000			400	\$8,000	1,000	\$20,000
Project mgmt - CSD (4)			20	\$1,000			20	\$1,000
<b>Contractual Services</b>	<b>600</b>	<b>\$12,000</b>	<b>20</b>	<b>\$1,000</b>	<b>400</b>	<b>\$8,000</b>	<b>1,020</b>	<b>\$21,000</b>
Work space for digitizers				\$1,400				\$1,400
<b>Supplies and Materials</b>				<b>\$1,400</b>				<b>\$1,400</b>
<b>Training</b>		<b>\$2,000</b>						<b>\$2,000</b>
<b>Overall Totals</b>		<b>\$25,000</b>		<b>\$18,200</b>		<b>\$13,000</b>		<b>\$56,200</b>

- (1) Personnel - Technical and Overall Project Mgmt - provided by Dept. of Nat. Resources personnel, based on est. hours at \$50/hr. includes technical & mgmt personnel, hardware, software, space, etc.
- (2) Capital Expenditures - relatively high end computer est. \$4,000; Arclnfo license for new computer and secondary Arclnfo license for existing computer est. \$10,000. This hardware/software will be available for anticipated followup efforts to develop NHD statewide. This line include \$5,000 from "Other Funding Sources" that is from the Nebr. Dept. of Environmental Quality in support of this project.
- (3) Digitizers -contracted through Conservation and Survey Division, UNL, and/or hired directly or contracted through other sources - based on estimate of \$20/hr. for approx. 1,000 hrs. by students contracted through the University and includes their overhead costs other than training, hardware or software. This line includes \$8,000 from "Other Funding Sources": \$3,000 Lower Elkhorn NRD and \$5,000 Dept. of Roads, in support of this project
- (4) Project coordination and management time provided on an in-kind basis by the Conservation and Survey Division - UNL to set up and oversee student digitizer program, based on est. hours at \$50/hr. includes personnel, hardware, software, space, etc.

\* In-kind Match - \$13,800 in an est. 276 hrs. of technical and mgmt. services from DNR's technical staff \$2,000 for an est. 20 hrs. of upper level DNR mgmt. time to establish & do the necessary interagency coord. \$1,400 for digitizer work space and \$1,000 for 20 hrs. of CSD proj. coord/mgmt. Each of these will be documented via letter and project timesheets to the extent each of these agencies maintain specific project timesheet accounting. In addition there is \$13,000 in collaborative funding from other state agencies and an NRD.

3. Match Requirement: This grant requires a 25% match from the agency. Please use the calculation below to ensure your application meets this requirement.

$$\frac{\text{Total Cash Match ①} + \text{Total In-Kind Match ②}}{\text{Total Project Cost ③}} \$ 0.25$$

$$\frac{\$18,200 \text{ Total In-Kind Match (plus \$13,000 in cash from other agencies)}}{\$56,200 \text{ Total Project Cost}} = 0.32$$



**Nebraska GIS Steering Committee Resolution Encouraging  
Cooperative Efforts to Develop a 1:24,000 National Hydrography Dataset for Nebraska**  
*passed on 7/5/01*

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- Whereas:* Water and water-related issues play an important role in the economic, legal, and political life of Nebraskans,
- Whereas:* Numerous state, federal, and local public agencies and private interests collect and maintain separate water-related data which is utilized in a wide variety of management and regulatory applications,
- Whereas:* The existence of a common hydrographic reference dataset would greatly enhance the ability of agencies to integrate multiple, stream-related datasets and thereby strengthen the resultant policy and management decision-making processes that depend on those datasets,
- Whereas:* The Federal Geographic Data Committee, the National States Geographic Information Council, the Nebraska GIS Steering Committee and numerous state and local agencies have all noted the importance of a common hydrography reference database and have designated geospatial databases of this type as a priority for development, and consequently, the Nebraska GIS Steering Committee established a Water Resources Database Advisory Committee to study and make recommendations related to the development of hydrographic databases,
- Whereas:* The Advisory Committee research determined that while the standards for the 1:100,000 scale National Hydrography Dataset (NHD), as developed jointly by the U.S. Geological Survey and the U.S. Environmental Protection Agency, incorporate an array of database features designed to facilitate its use as a common geospatial reference dataset for a wide array of stream-related data collection and applications, a hydrographic dataset developed at the 1:100,000 scale does not have sufficient spatial accuracy (90% of the points within 167 feet) and that an NHD dataset developed at the 1:24,000 scale (90% of the points within 40 feet) is more appropriate for many of these state and local applications,
- Whereas:* Based on its Advisory Committee recommendation, the GIS Steering Committee voted to encourage and facilitate cooperative efforts by state, local, and federal agencies to undertake 1:24,000 National Hydrography Dataset pilot projects as an important step toward the development of a statewide database.
- Whereas:* An initial 1:24,000 NHD pilot project, in the Logan Creek watershed area of northeast Nebraska, has been completed. The Department of Natural Resources took the lead in this interagency pilot project and demonstrated the feasibility of producing high-resolution NHD in-house, provided a baseline for likely resource requirements for future NHD efforts, and identified and resolved several standards issues related to a Nebraska NHD.

*Now Therefore, be it resolved:*

- Section 1* That a 1:24,000 scale National Hydrography Dataset (NHD), based generally on 1:100,000 scale NHD standards, but with an enhanced, updated 1:24,000 stream vector coverage, will provide Nebraska with a common geospatial reference database that is needed for a wide range of applications for which the location and/or the characteristics of streams or other water bodies is an important consideration, and therefore this geospatial database is a high priority for statewide, database infrastructure development.
- Section 2* In pursuit of this common goal, the Nebraska GIS Steering Committee requests that cooperating agencies review current and planned projects that might involve water-related geospatial database development efforts to determine the feasibility of incorporating 1:24,000 NHD standards and database development efforts into those projects, and encourages state, local and federal agencies to actively explore other possibilities for supporting cooperative efforts to undertake 1:24,000 NHD development.
- Section 3.* In further pursuit of this goal, the GIS Steering Committee states its support for a pending grant application to the Nebraska Information Technology Commission for NHD development and for the on-going, active pursuit of other available grants and funding opportunities to support Nebraska NHD development and offers the support of the Steering Committee Coordinator to help facilitate these efforts

# A PROPOSAL FOR COMPILATION OF A NATIONAL HYDROGRAPHY DATASET FOR NEBRASKA

*Approximately 200 years ago, Lewis and Clark used the technology of the time to explore and map the Missouri River and its tributaries. As we approach the bicentennial of this historic undertaking, it is fitting that we utilize today's information technology to digitally map Nebraska's portion of the Missouri River and its tributaries. Just as the Missouri River was important to our young nation at the time of the Voyage of Discovery, so to are today's streams and rivers important to our state's economy, public health and safety, and environment. The use of modern information technology enables us to cooperate in the collection, sharing, and cross-referencing of large amounts of data related to Nebraska's surface water and to analyze that data to better manage and protect this important resource.*

## 1. Background / Purpose

The National Hydrography Dataset (NHD) is a dataset model developed jointly by USGS and EPA with a goal of providing a common reference digital hydrographic dataset for a wide cross-section of applications using data related to surface water features. The purpose of this document is to propose creation of a detailed NHD digital map/dataset for Nebraska. Such a dataset, compiled at a 1:24,000 scale would present water features at the same scale as other state digital mapping packages. It would better enable spatial comparison of a wide range of water, landscape, social and other data. More importantly it would provide the basis for, or enhance the efficiency of, a wide range of potential water analysis and administration activities. While a 1:100,000 dataset is currently available, it simply cannot adequately support these types of uses.

The NHD is also recognized by the Federal Geographic Data Committee as a Framework Database, which provides a common data structure for organizations concerned with natural resources to build upon. A pilot project for the Logan Creek area of the state has recently been completed and a further effort has been funded for the Salt-Wahoo watershed.

The proposed statewide project would be managed by the Nebraska Department of

Natural Resources with portions of the effort being housed and completed through the Conservation and Survey Division of the University of Nebraska – Lincoln. The proposed project would cost about \$1.8 million and take approximately four to five years to complete. The completed database will be housed and maintained at the Nebraska Department of Natural Resources. However, it will also be made available digitally to public or private entities for a wide variety of uses.

***As important as water is to Nebraska — state, local and federal agencies do not currently have access to an accurate and comprehensive digital map of Nebraska's streams and other surface water features.***

From a technical standpoint the NHD would provide spatial accuracy of water features comparable to a 1:24,000 scale map based on 1993 to 1999 imagery. It would include EPA reach codes, a centerline stream network to facilitate modeling and common names as an attribute of stream segments.

## Anticipated Uses of a Nebraska NHD

The NHD supports a variety of uses that would be impractical or, in some cases impossible with existing digital hydrographic databases, including uses (see [Appendix](#) for additional details) related to:

- *Hydrologic Analysis*
- *Water Rights Administration*
- *Floodplain Mapping*
- *Surface Water Quality Assessment*

- *Total Maximum Daily Load & Waste Load Allocations Permits*
- *TMDL for Non-point Source*
- *Standard Reference for Surface Water Sample Sites*
- *Fisheries Management and Enhancement*
- *Wildlife Management and Protection*
- *Enhanced Lake Information*
- *Bridge Design*
- *Surface Water Buffer Strips*
- *Drainage Basin Characteristics*
- *Standardized Stream Segment Delineation and Identification*

## 2. Synopsis of the Proposed Project

The proposed project would result in creation of a statewide national hydrographic dataset at 1:24,000 scale. It would involve six and one half full time equivalent positions per year over a period of four years. Because of potential time complications in hiring and retaining digitizing staff, it is possible the project may take up to five years. However, no increase in cost would be expected should the extra time be required. With training, software, equipment and workspace requirements included it would cost about \$1.8 million. The project would be managed by the Nebraska Department of Natural Resources with the cooperation and participation of the University of Nebraska – Lincoln Conservation and Survey Division.

The above estimates are derived in part from the experience of the Department of Natural Resources in compiling the Logan Creek Watershed pilot project. That experience indicated that the process averaged about ¼ hour per mile of stream mapped at 1:100,000 scale (actual stream miles digitized for the 1:24,000 scale project are about double those mapped at 1:100,000 scale). There are, according to EPA estimates approximately 108,832 total river miles in Nebraska at 1:100,000 scale. That would translate into approximately 27,250 hours of digitizing or

about 15FTE at 1850 actual digitizing work hours per FTE. In addition training/project instruction time is likely to require another 1 FTE for a total of 16 FTE for digitizing stream segments

Because of the scope of the project and the need for backup skills it is estimated that management and technical processing will take a larger portion of time than they did for the Logan Creek pilot project. Management of digitizing is expected to take about 1 FTE per year for a total of 4 FTE and all other technical processing and management is expected to take about 1.5 FTE per year for a total of 6 FTE. Part of that effort would be to make sure a second person has the skills to manage the project if needed. It is expected that with the noted personnel commitments the technical processing would approximately keep pace with the digitizing.

Thus the overall project is expected to require about 16 FTE in digitizing personnel and 10 FTE in professional management and technical processing. The total project would require about 26 FTE over 4 years for a total of 6 ½ FTE per year (4 digitizing and 2 ½ management/technical processing).

Cost for digitizing personnel would be an estimated \$20 per hour. This work would probably be contracted through the University and includes their overhead costs other than training, hardware or software. It would also likely involve mostly half time personnel. For 16 FTE at 1850 hours apiece per year this would likely cost about \$592,000. The cost for managerial/technical processing personnel would likely be about \$60 per hour for 10 FTE at 1850 hours, or \$1,110,000. This would total \$1,702,000 and would also include overhead and staff time for training (but not hardware, software and other training costs). The final cost category would be hardware, software and tuition-travel expense for training. This would be expected to cost approximately \$50,000 for hardware and software and \$17,000 for tuition and travel for training. Thus total project cost is expected to run about \$1,769,000.

<b>Statewide NHD - Estimated Project Costs</b>				
Digitizing personnel:	16 FTE x 1850 hours x \$20 hour =			\$ 592,000
Managerial/Tech Processing:	10 FTE x 1850 hours x \$60 hour =			\$1,110,000
Hardware/Software:				\$ 50,000
Tuition and Travel for Training				\$ 17,000
<b>TOTAL</b>				<b>\$1,769,000</b>
<b>Statewide NHD – Estimated Costs Per Year (Scheduled Project Duration 4 Years)</b>				
<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>	<u>Total Cost</u>
\$442,250	\$442,250	\$442,250	\$442,250	\$1,769,000

Schedule. The project is expected to take approximately 4 years from the point of initiation with approximately equal costs each year. Complications in hiring and retaining digitizing staff might result in the extension of the project to five years, although no extra costs would be expected should the extension be required. It is estimated that year one would have less money devoted to personal services since hiring of qualified staff would take some time. However, that would be offset by the start-up costs for training, hardware and software.

Management. The project would be managed by the Nebraska Department of Natural Resources. That agency would be the recipient for grants and would disburse project funds.

Training – Initiation. Hiring and training needs may result in a brief time lag before the project is fully functional. It also seems likely that over time experience will result in some efficiencies in both the digitizing and the attribution process.

Quality Assurance/Quality Control. Because the NHD is a national database it is important that effort be made to see that outputs meet national standards. It is anticipated that an arrangement could be reached with the U.S. Geological Survey to meet final quality assurance / quality control needs.

### 3. Alternate Approaches

**A.** U.S. Geological Survey cost estimates from the fall of 2000 indicated that it would cost approximately \$5 million to contract with

private vendors to develop a comprehensive set of updated DLGs of all Nebraska rivers and streams. Added to those mapping costs are the costs associated with incorporating into the database the special attribute features of the NHD, which is what makes it such a powerful multipurpose standard reference set. A USGS based rough estimate for those additional attributing/technical processing costs is approximately \$700,000. Although USGS would potentially be able to eventually cost share on such development costs, it is already far behind on commitments it has made to other states to jointly develop this dataset.

**B.** An additional alternate approach that could be developed during the course of the effort would be to use photogrammetric methods to develop the NHD. With this methodology a new, more accurate digital elevation model would also be produced thus enhancing the value provided by the overall project. If this method were found to be feasible, the approach of the project could be changed after it is underway.

### 4. Project Outcome

Water is a very important issue for Nebraska's economy, environment, public safety and overall quality of life. If completed on a statewide basis, this project would fill a major void in the data infrastructure necessary to efficiently and accurately apply information technologies, such as GIS, to a wide array of public policy applications related to surface water. As important as water is to Nebraska — state, local and federal agencies do not currently

have access to an accurate and comprehensive digital map of Nebraska's streams and other surface water features. The cooperative development of such a digital map/database would enable agencies to use the locational/spatial aspect of surface water features to illustrate and/or explore the relationships of surface water to a wide variety of other phenomenon. The numerical identifiers for stream segments and other surface water features, which are built into the NHD model, would also provide a standardized means to reference, link and integrate a wide array of surface water data collected by a variety of agencies.

This project would develop a high-resolution, current, and comprehensive statewide dataset of Nebraska's surface water features. The overall intent is to develop a dataset, which would serve as a standard reference dataset for a wide

variety of agencies and organizations that collect, analyze and use data related to surface water. The use of such a standard reference dataset by multiple agencies would greatly enhance the ability to analyze and cross-reference the surface water-related data that has been collected by multiple agencies. Ultimately, it would add to the accuracy and efficiency of administering a variety of water programs.

While this project would require a substantial investment of public resources, it is an investment that would pay long-term dividends in terms of improved public policy development and implementation, and if maintained this dataset will return these dividends for at least the next 30-40 years.

## Appendix To "A Proposal for Compilation of A National Hydrography Dataset for Nebraska" – Detail on Anticipated Uses of a Nebraska NHD

To illustrate the widespread need for a high-resolution surface water features database, some detail on the broad range of potential applications are provided below.

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### Hydrologic Analysis

Any hydrologic analysis or process that currently relies on information derived from a 7 1/2 minute quadrangle map would greatly benefit from the development of a Nebraska NHD. For instance, each time a bridge, culvert, or other drainage structure or system is analyzed in the state by federal, state, or local government a tremendous savings in the time to analyze the drainage characteristics would be recognized by having NHD. For example, at the Department of Roads, this would extend outside the Bridge Division into Roadway Design and Project Development. At the county level, the adequacy of every culvert and bridge in every county in the state will be assessed at some point in time. For drainages over a couple hundred acres, information from the NHD would be used for these assessments. The availability of a 1:24,000 NHD would have a tremendous impact in the hydrology/hydraulics design area.

### Water Rights Administration

An accurate and complete 1:24,000 NHD type spatial database of streams would also be used in DNR's water rights mapping program. The Department has set a goal to digitize its water rights maps. An accurate stream, lake and reservoir network would be an important element in those maps. DNR has indicated that it would be useful to tie its downstream order identification system to stream ordering schemes used by other agencies. The stream reach coding implemented in the NHD projects would be useful for this purpose.

### Floodplain Mapping

The Floodplain Management/Dam Safety Division of the Dept. of Natural Resources (DNR) is currently working on a "Large Area Floodplain Mapping Initiative" that would

utilize a statewide, high quality vectorized stream coverage at a scale of 1:24,000 or better. Currently, this initiative utilizes Digital Elevation Models (DEM) and Digital Orthophoto Quads (DOQ) databases along with existing hydrologic and hydraulic information, and other engineering computations required to map 100-year floodplains throughout the state. The vectorized stream data available through NHD would greatly enhance the results of this Large Area Floodplain Mapping Initiative and make it possible to plot the base flood elevations directly on the maps. Without vectorized stream data it is not possible to directly calculate base flood data. The computation process requires accurate stream lengths and slopes along the stream reaches, which are not adequately provided by the DEMs. Other sources of information, such as TIGER line files, also do not provide the necessary accuracy for this project.

The Floodplain Management/Dam Safety Division of DNR has indicated that they would use NHD on a daily basis as a tool to calculate base flood data in parts of the state (about 95% of the state) where detailed mapping has not been provided to local governments. Today, the data for such requests has to be manually determined from the 7 1/2-minute quads. About half the state currently does not have floodplains identified. The DNR will continue to map these areas - NHD would enhance and expedite the delineation process.

### Surface Water Quality Assessment

DEQ's water quality assessments are based on sampling to represent entire segments. Similarly DEQ's reporting reflects the support or non-support of uses assigned in the Standards. They report their results as miles of streams supporting, which segments support, acres of lakes, which lakes support, etc. EPA requires this method of reporting for their

programs. Since the basis of DEQ's reporting units are the waterbodies identified in T117, use of a 1:24,000 scale coverage would be preferred when using GIS applications in this activity.

### **Total Maximum Daily Load and Waste Load Allocations Permits**

The Total Maximum Daily Load calculations (TMDL) and Waste Load Allocations (WLA) for the Nebraska Department of Environmental Quality permits program result in enforceable permit limits on point sources of pollution. These calculations rely on hydrologic variables as input to a modeling process in addition to the linear routing. These hydrologic attributes and routing are included in an NHD. Since the basis of DEQ's authority for these permits relies on Title 117, use of a 1:24,000 scale coverage would be preferred over a 1:100,000 scale in a GIS environment. The use of 1:24,000 NHD would provide a significantly higher level of accuracy for TMDLs and WLAs, especially since more drainages are described at this scale of NHD." This greater accuracy will insure that wastewater treatment is provided where it is needed and not required where it is not necessary.

### **TMDL for Non-point Source**

DEQ's TMDL efforts for the nonpoint source program uses similar information as outlined above for stream segments, except in a non-regulatory manner. The same rationale for needing 1:24,000 scale coverage holds for the nonpoint source program.

### **Bridge Design**

The Bridge Division of the Nebraska Department of Roads anticipates the use such a surface water database in the hydrologic modeling they do related to the design of bridges. An accurate depiction of the current location and shape of the streambed, combined with Digital Elevation Models (DEMs) and a logically connected stream flow network would enhance their ability to conduct upstream flow analyses.

### **Fisheries Management and Enhancement**

The Fisheries Division of the Nebraska Game and Parks Commission (NGPC) would use this data for species mapping and watershed analysis around state lakes. Watershed planning is important to maintain the quality of fisheries in state lakes. A better definition of stream networks, water bodies, and watersheds within the area around state lakes would be beneficial to this effort. Presently existing databases of stream conditions collected by field personnel could be referenced to such a standard reference database. Some of the data that is collected is on water courses that are not represented in existing GIS databases and if existing, the Fisheries Division would utilize this data.

### **Wildlife Management and Protection**

Good representation of stream networks would allow the NGPC to better map Threatened and Endangered Species and non-threatened species locations. Attribute information on perennial/intermittent status and accurate stream name attributes as well as canal locations and attribute information can be included in the data set. An improved stream network can allow stream flow modeling for wildlife and fisheries.

### **Enhanced Lake Information**

The NGPC Parks Division would use improved lakes coverages for mapping in State Recreation Areas and State Parks. The Wildlife Division would benefit as it relates to Wildlife Management Area locations. The Fisheries division would use this data set for species mapping and watershed analysis around state lakes.

### **Standard Reference for Surface Water Sample Sites**

The Central Platte Natural Resources District sees such a database as useful for providing standard reference numbering and locations for stream water flows and water quality samples that the NRD collects. It also offers a potential approach for numbering and locating stream cross sections and profiles.

## Drainage Basin Characteristics

The Central Platte NRD also sees that such a database may provide a means to develop drainage basin characteristics above various locations in the river basin. For example, pick a highway or county bridge crossing on a stream what is the drainage area, average slope, centroid of basin, 100-year flood hydrograph, etc.

## Surface Water Buffer Strips

The Department of Agriculture is charged under the Buffer Strip Act, (2-5101 to 2-5111) to devise and oversee implementation of a statewide vegetative buffer strip plan for the areas around surface water features with the goal of improving the quality of the domestic and public water supply. The Natural Resources Conservation Service - USDA is also actively seeking to incorporate such buffer strips into their farm conservation plans. A high-resolution surface water features database would be a valuable tool to assist in prioritizing areas and monitoring the impact of these programs.

## Standardized Stream Segment Delineation and Identification

Stream segment delineation contained in Title 117 - Nebraska Surface Water Quality Standards is based on the information contained on USGS 1:24,000 scale quad maps. If the NDEQ is to use GIS tools in describing or implementing T117, geospatial data based on the 1:24,000 scale maps would be preferable.

## Additional Department of Natural Resources Uses

Such a database would allow DNR's Dam Safety Program Engineer to enhance his dam site maps. The ground water registration section may be able to use it as a tool to identify wells in close proximity to a stream; which would require the well owner to obtain a surface water permit. The database would also be useful in scientific and administrative programs dealing with interstate compacts and litigation support, as well as, watershed planning, terrain modeling and other project studies.